

CLAIMS

1. A method for treating hematopoietic diseases, wherein the method comprises administering any one of the proteins selected from the group consisting of (a) to (b) shown below, or a
5 polynucleotide encoding the protein:
 - (a) a protein comprising the amino acid sequence of SEQ ID NO: 2;
 - (b) a protein comprising an amino acid sequence with one or more amino acid substitutions, deletions, insertions, and/or additions in the amino acid sequence of SEQ ID NO: 2, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of
10 SEQ ID NO: 2;
 - (c) a protein encoded by a polynucleotide that hybridizes under stringent conditions with a polynucleotide comprising the nucleotide sequence of SEQ ID NO: 1, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2;
and
 - 15 (d) a protein encoded by a polynucleotide comprising a nucleotide sequence with at least 70% or higher homology to the nucleotide sequence of SEQ ID NO: 1, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2.
2. The method of claim 1, wherein the hematopoietic diseases are diseases caused by abnormal
20 erythroblast differentiation.
3. The method of claim 1, which comprises introducing into hematopoietic stem cells a vector harboring the polynucleotide in an expressible state.
- 25 4. A method for inducing erythroblast differentiation, wherein the method comprises expressing in hematopoietic stem cells any one of the proteins selected from the group consisting of (a) to (d) shown below:
 - (a) a protein comprising the amino acid sequence of SEQ ID NO: 2;
 - (b) a protein comprising an amino acid sequence with one or more amino acid
30 substitutions, deletions, insertions, and/or additions in the amino acid sequence of SEQ ID NO: 2, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2;
 - (c) a protein encoded by a polynucleotide that hybridizes under stringent conditions with a polynucleotide comprising the nucleotide sequence of SEQ ID NO: 1, wherein the protein
35 is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2;
and

(d) a protein encoded by a polynucleotide comprising a nucleotide sequence with at least 70% or higher homology to the nucleotide sequence of SEQ ID NO: 1, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2.

5 5. A pharmaceutical formulation for treating hematopoietic diseases, wherein the formulation comprises as an effective ingredient any one of the proteins selected from the group consisting of (a) to (d) shown below, or a polynucleotide encoding the protein:

(a) a protein comprising the amino acid sequence of SEQ ID NO: 2;

10 (b) a protein comprising an amino acid sequence with one or more amino acid substitutions, deletions, insertions, and/or additions in the amino acid sequence of SEQ ID NO: 2, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2;

15 (c) a protein encoded by a polynucleotide that hybridizes under stringent conditions with a polynucleotide comprising the nucleotide sequence of SEQ ID NO: 1, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2; and

(d) a protein encoded by a polynucleotide comprising a nucleotide sequence with at least 70% or higher homology to the nucleotide sequence of SEQ ID NO: 1, wherein the protein is functionally equivalent to a protein comprising the amino acid sequence of SEQ ID NO: 2.

20 6. The pharmaceutical formulation of claim 5, which is a hematopoietic stem cell harboring the polynucleotide in an expressible state.

25 7. A method for treating hematopoietic diseases, wherein the method comprises administering an agent that enhances the activity of a protein comprising the amino acid sequence of SEQ ID NO: 2.

30 8. A therapeutic agent for hematopoietic diseases, which comprises an agent that enhances the activity of a protein comprising the amino acid sequence of SEQ ID NO: 2 as an effective ingredient.

9. A non-human hematopoietic disease model animal embryo whose synoviolin gene function is defective.

35 10. The non-human hematopoietic disease model animal embryo of claim 9, wherein the non-human animal is a rodent.

11. The non-human hematopoietic disease model animal embryo of claim 10, wherein the rodent is a mouse.

5 12. The non-human hematopoietic disease model animal embryo of claim 11, which is an embryo of E13.5 or younger.

13. The non-human hematopoietic disease model animal embryo of claim 9, wherein the hematopoietic disease is a disease caused by abnormal erythroblast differentiation.

10

14. A hematopoietic disease model cell derived from the non-human hematopoietic disease model animal embryo of any one of claims 9 to 13. ✓

15. The hematopoietic disease model cell of claim 14, which is a fibroblast.

15

16. A method of screening for therapeutic agents for hematopoietic diseases, wherein the method comprises administering a test substance to a non-human hematopoietic disease model animal embryo whose synoviolin gene function is defective, and evaluating the condition of erythroblasts in the non-human animal embryo.

20

17. A method of screening for therapeutic agents for hematopoietic diseases, wherein the method comprises the steps of:

(a) administering or contacting an ER stress-inducing agent with a non-human hematopoietic disease model animal embryos whose synoviolin gene function is defective, or a cell derived from the embryos;

25

(b) administering or contacting a test substance to the hematopoietic disease model non-human animal embryos whose synoviolin gene function is defective, or cells derived from the embryos, before, after, or simultaneously with step (a); and

(c) determining cells in which apoptosis was induced from among the non-human animal embryos or the cells derived from the embryos.

30

18. A method of screening for ER stress-removing agents, wherein the method includes the steps of:

(a) acting an ER stress-inducing agent on cells whose endogenous synoviolin gene function is defective;

35

(b) contacting a test substance to the cells before, after, or simultaneously with step (a);

and

(c) determining cells in which apoptosis was induced from among the cells.